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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/590,011

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Takeshi Hikata

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EXAMINER

HORNING, JOEL G

ART UNIT

PAPER NUMBER

1712

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/590,011	Applicant(s) HIKATA, TAKESHI	
	Examiner JOEL G. HORNING	Art Unit 1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 December 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-6 and 8-15 is/are pending in the application.
- 4a) Of the above claim(s) 8-15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11-10-2010</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Claims 8-15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on May 29th, 2009.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
2. **Claims 1 and 3-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Delzeit (US 6858197).

The instant claims are directed towards a catalyst structure ***that is shaped as a pipe with its upper surface capable of serving as a crystal growth surface,*** which can be used to make carbon nanotubes by vapor deposition, which includes a catalytic material which forms a ring on a crystal growth surface, ***and at least part of a side of said pipe shaped structure has a non-catalytic material with***

substantially no catalytic activity with respect to a growth of said crystalline carbon.

Delzeit is directed towards a catalyst structure for depositing carbon nanotubes by a vapor deposition method, which includes a surface with a layer of catalyst material which is formed into a desired pattern (abstract),.

Delzeit further teaches that a catalyst structure having a multilayer catalyst material with an even surface and a first layer of aluminum (which is exposed on the outside of the structure and not taught to be catalytic), a second layer of catalytic iron, cobalt, or nickel covered by a third layer of catalytic molybdenum, can then be coated with an overlayer material (which puts it exposed on the outside [as shown each layer is exposed on the outside] as well as the top side of the catalyst structure, see figure 4) of silver (**claims 3 and 4**). This overlayer material is not taught to be catalytic and does not appear to contribute to catalysis, instead having the function of coating the outside of the grown nanotubes (col 4 line 57 through col 5, line 3). Additionally, since applicant claims that silver can be the non-catalytic material, it must have "substantially no catalytic activity with respect to a growth of said crystalline carbon." Hence the multilayer structure of the crystal growth surface is composed of catalytic (iron, cobalt, nickel and/or molybdenum) and non-catalytic (aluminum and silver) materials (**claim 5**).

Regarding the shape of the pattern, Delzeit further teaches that the structure of the catalyst can be formed into arrays (an assembly of a plurality of catalyst structures) by using masks with regular or irregular arrays of apertures. These apertures can each be formed into a wide variety of aperture patterns, shapes,

even numbers or letters, such as the number 8 which is a two pipe structure, or zero, which would be a single pipe aperture (fig 2G, figure 3, col 4, lines 23-41).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to create the multilayer molybdenum catalyst layer with the silver non-catalytic layer on the top side of the structure in the shape of a pipe, which would make the catalyst in the shape of a ring, since these materials are explicitly taught to be suitable for the catalyst material and the shape is explicitly taught to be a suitable shape for the catalyst material.

Applicant now requires that the catalyst ring correspond, in some way, to a carbon nanotube. However, since no specific carbon nanotube is being compared to it, this is open to broad interpretation. For instance, the diameter of the ring could correspond to the length of a carbon nanotube that is that length. Delzeit teaches that the carbon nanotube length depends upon the structure of the catalyst (col 1, lines 40-45), so the ring structure will correspond to the length of the carbon nanotubes that are grown on it. Additionally, Delzeit teaches that the catalyst structure can be patterned small enough that only a single nanotubes may grow on it (col 6, lines 10-18). In that case, the catalyst structure will correspond to a single carbon nanotube that grows on it, also meeting the claim limitation (**claim 1**).

Furthermore, given the teaching of Delzeit of forming the catalyst into the shape of letters and numbers, it would have been readily apparent to a person of ordinary skill in the art at the time of invention to make the catalyst shape into any letter or number shape, including the letter "O" or the number zero, which are (along

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with many other numbers and letters) considered “pipe” shapes and would produce ring shaped catalyst layers (**claim 1 alternate basis**).

3. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Delzeit (US 6858197) in view of Fan et al (Science vol 283, pages 512-514, (1999)).

The instant claim requires that the crystal growth surface of the catalyst be oxidized.

Delzeit teaches using iron as the nanotube catalyst (abstract), but does not teach oxidizing its surface.

However, Fan et al is also directed towards patterning and vapor deposition of carbon nanotubes (abstract) by selective deposition of iron as a catalyst material, which then has its surface oxidized (page 512, col 2, lines 1-10). Fan et al further teaches that the resulting iron oxide material acts as a suitable catalyst to decompose precursor vapors so that they then form carbon nanotubes (page 513, col 1, lines 1-5).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to substitute the iron catalyst of Delzeit with the iron oxide catalyst of Fan as a known alternative catalyst material known to be suitable for the deposition of carbon nanotubes which would produce predictable results (**claim 6**).

Response to Arguments

4. Applicant's arguments with respect to claims 1 and 3-6 have been considered but are not convincing in view of the new ground(s) of rejection necessitated by amendment.

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5. Applicant argues that Delzeit does not make it obvious to produce “a catalyst structure in the shape of a pipe, but rather produces them in layers, as shown in figures 1.4 and 5. Those figures show how the different layers of the catalyst are deposited relative to each other. They do not show all the different shapes that layered structure can be formed in. Delzeit teaches that in figures 2(a-k), so the white raised ring portions of the figure 8 would be layered as shown in figures 1, 4 or 5, giving them depth, which makes them shaped like a pipe.
6. Applicant argues that the limitation requiring that at least part of a side of the structure shaped as a pipe has a non-catalytic material with substantially no catalytic activity with respect to the growth of crystalline carbon, has not been met by Delzeit. However, as stated in the remarks to the previous office action, the non-catalytic silver and aluminum **42** or **45** are shown in figure 4 to both be exposed on the outside of the catalyst structure and so parts of the outside of the layered catalyst structure has non-catalytic material with substantially no catalytic activity with respect to a growth of said crystalline carbon.
7. Regarding applicant's argument that Delzeit's catalyst structure is design to control the regions where the nanotubes are grown and not, like applicant's, control the shape of individual carbon nanotubes, these are method limitations, but the claims are directed towards an apparatus or product. Delzeit's catalyst structure reads upon the claims and could even be used for such a shape control depending upon the size of the nanotubes (applicant's intended use). It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus

satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

8. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Conclusion

9. No current claims are allowed.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./
Examiner, Art Unit 1712

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1712